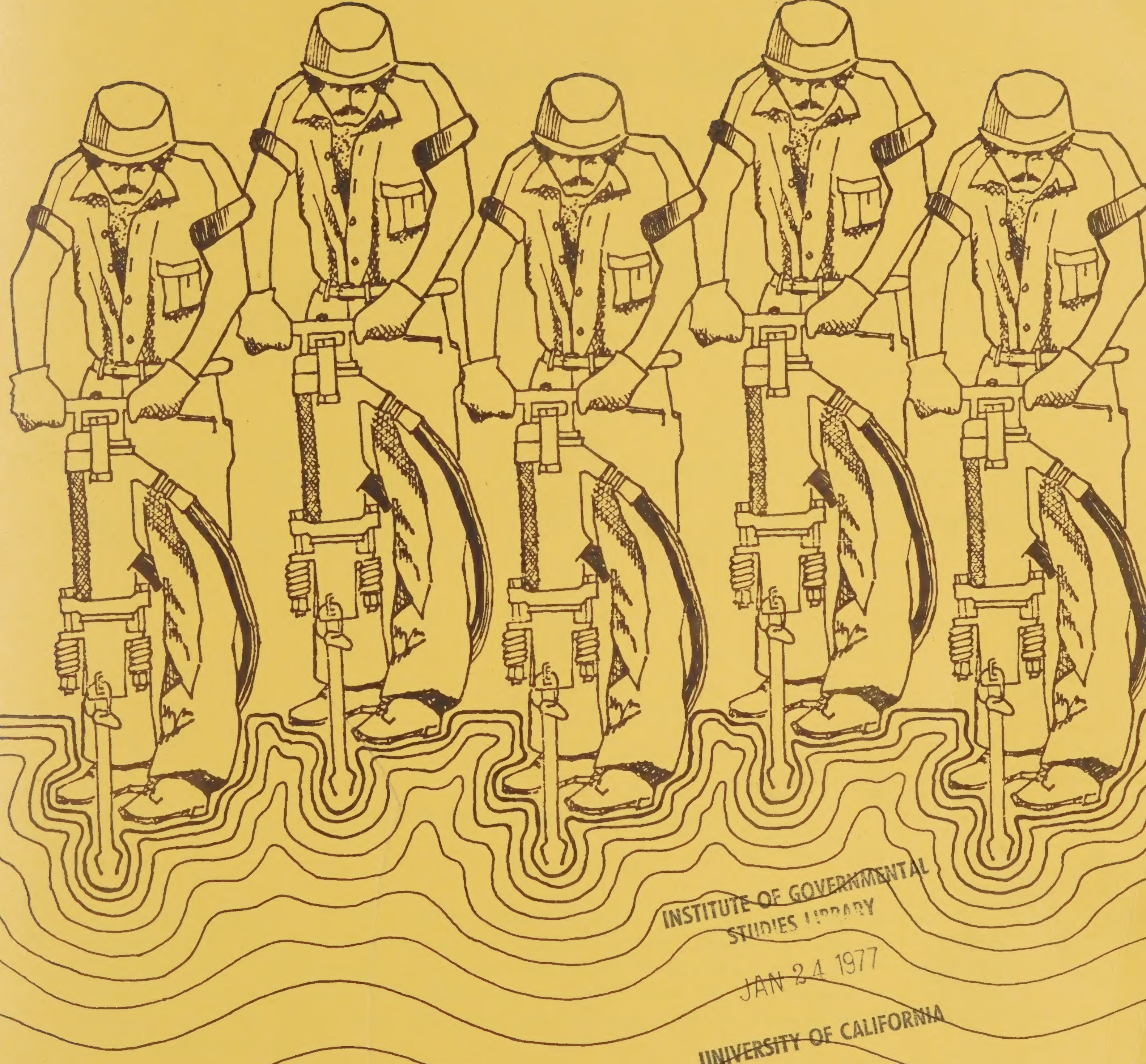





# noise element

## kern county general plan

# CERTIFICATION OF ADOPTION

KERN COUNTY PLANNING COMMISSION

By Resolution Number 46-75, dated April 21, 1975, the Kern County Planning Commission adopted the herein-contained Noise Element of the Kern County General Plan after conducting a public hearing in compliance with all statutory requirements of the State of California and all ordinance requirements of the County of Kern.

Stephen Barker Jr.

STEPHEN BARKER, JR., Chairman
Kern County Planning Commission

Jack L. Dalton

JACK L. DALTON, Director/Secretary

KERN COUNTY BOARD OF SUPERVISORS

By Resolution No. 75-246, dated June 2, 1975, the Kern County Board of Supervisors adopted the herein-contained Noise Element of the Kern County General Plan after receiving a recommendation thereon from the Kern County Planning Commission and conducting a public hearing pursuant to all statutory requirements of the State of California and all ordinance requirements of the County of Kern.

JOHN C. MITCHELL, Chairman
Kern County Board of Supervisors

VERA K. GIBSON, County Clerk and
Ex-Officio Clerk of the Board of
Supervisors

# N O I S E   E L E M E N T

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TABLE OF CONTENTS

Page

## LIST OF TABLES

## LIST OF FIGURES

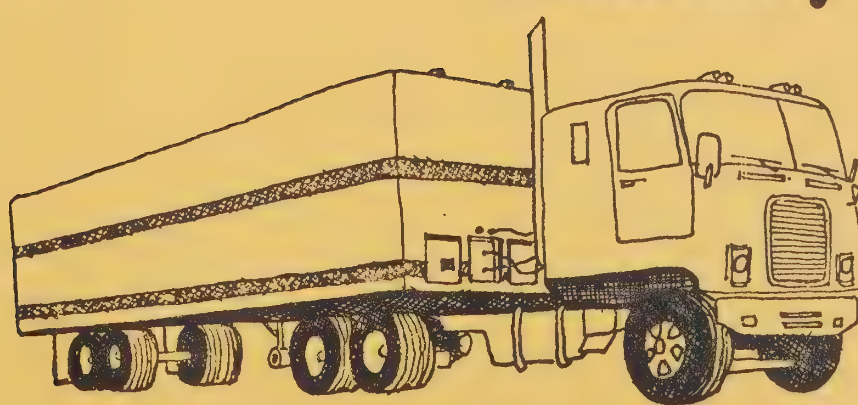
## ACKNOWLEDGEMENTS

The Kern County Planning Department received considerable assistance from the Kern County Health Department in the development of this Element. Their services, particularly those of Jim Buntin, in development of noise contours and other technical matters, are gratefully acknowledged.

"The crescendo of noise--whether it comes from truck or jackhammer, siren or airplane, shatters serenity and can inflict pain. We dare not be complacent about this ever mounting volume of noise. In the years ahead, it can only bring even more discomfort--and worse--to the lives of people."

--Lyndon B. Johnson, 1968

# summary



# G O A L S

- To protect the health of Kern County residents
- To minimize disruption of human activities and conflicts resulting from excessive noise
- To protect the economic base of the county
- To establish reasonable standards for maximum desired noise levels in Kern County
- To develop an implementation program which will effectively deal with the noise pollution problem in Kern County

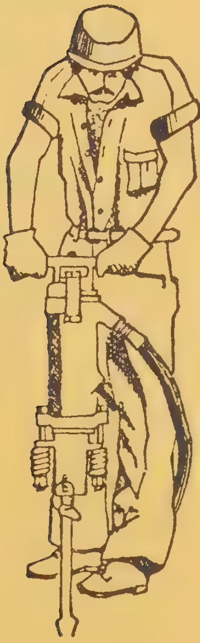
# P O L I C I E S

- Utilize good land use planning principles to reduce conflicts related to noise emissions
- Maintain stringent controls over noise emissions from new development
- Utilize all feasible controls over construction and other temporary noise sources
- Require reductions in noise from existing sources wherever possible
- Employ the best available methods of noise control

## RECOMMENDATIONS

- Utilize zoning regulations to assist in achieving noise-compatible land use patterns
- Require proper acoustical treatment of transportation facilities, including highways, airports, and railroads
- Establish noise impact zones where new development will be reviewed with respect to noise problems
- Establish a noise evaluation committee
- Maintain a noise monitoring program throughout the county
- Develop a public information program with respect to noise and its effects
- Encourage cooperation between the County and the incorporated cities within the County to control noise

# introduction



Because of its rural character, much of Kern County does not now have a serious noise pollution problem. However, as the county continues to grow and previously undeveloped areas are built up, the noise levels will continually increase. The major goals of this element are to establish reasonable standards for maximum desired noise levels in Kern County and to develop an implementation program which will effectively deal with the noise pollution problem.

## Mandatory Element

The importance of controlling noise is recognized in the state law, which now lists the noise element as one of the mandatory elements of the General Plan [Government Code Section 65302(g)]. The law requires each local jurisdiction to prepare a statement of policy indicating its intentions regarding noise and noise sources in the community. These jurisdictions also are to establish desired maximum noise levels according to land use category and to set standards for noise emissions from transportation facilities and from fixed-point sources. Each noise element also must contain a program for implementation of noise control measures.

## Noise Contours

The state law pays particular attention to noise emitted from transportation sources. It requires development of "noise contours" for these sources. Such a contour is a line passing through points where the same sound level prevails, and the contours form bands of varying width indicating sound emanating from a particular source.

This element is designed to present an overview of the noise problem for the layman and to describe the standards, policies, and implementation strategy to be utilized in Kern County. For those desiring more detailed information about the problem, an appendix containing explanations and technical background is included in this report.

## Effects of Noise

There are a number of ways in which people and their environment are affected by noise. Generally these effects fall into two broad categories: annoyances and damage to health. The difference between these is not always distinct; noises which are annoying may result in eventual physical symptoms such as ulcers, and extremely loud noises are likely to be both annoying and harmful. People react differently to the same noise, largely because of inherent differences between individuals.

The primary health effect of noise is, of course, hearing loss. An estimated 16 million Americans suffer from some degree of hearing loss directly caused by noise. Many of the losses are incurred by employees in industries where high noise levels are present, and compensation payments for such injuries run to millions of dollars each year.[1] In addition to direct damage to hearing from high noise levels, there is another way in which environmental noise endangers hearing. Studies have shown that people require periods of quiet in order to recover from noise overexposure. If the level of environmental noise is too high, this recovery is prevented.

Another important health effect is sleep interference (Figure 1). Noises which cause a person to awaken are annoying as well as detrimental to health. Sleep interference can cause irritability, mental disorganization, dreaming while awake, and other disorders. Noise also can disrupt the normal sleep pattern without awakening the individual, and this interference results in general fatigue.[2] A related problem is dream interference, a subject some psychiatrists have studied. Dr. Julius Buchwald, of the New York State Medical Center, believes that such interference may cause nightmarish memories, paranoidal delusions, hallucinations, suicidal and homicidal tendencies, reduced sense of humor, and inability to handle everyday problems.[3]

Other health effects are referred to as extraauditory physiological effects. These include muscular reflexes ("startle response"), constriction of peripheral blood vessels, changes in respiratory and heart rate, neuro-endocrine system reflexes (including ulcers and other stress reactions), and other neurological responses such as nystagmus (involuntary rapid oscillation of the eyeball) and vertigo. Although definitive research has yet to be done,

## SLEEP DISTURBANCE FROM NOISE

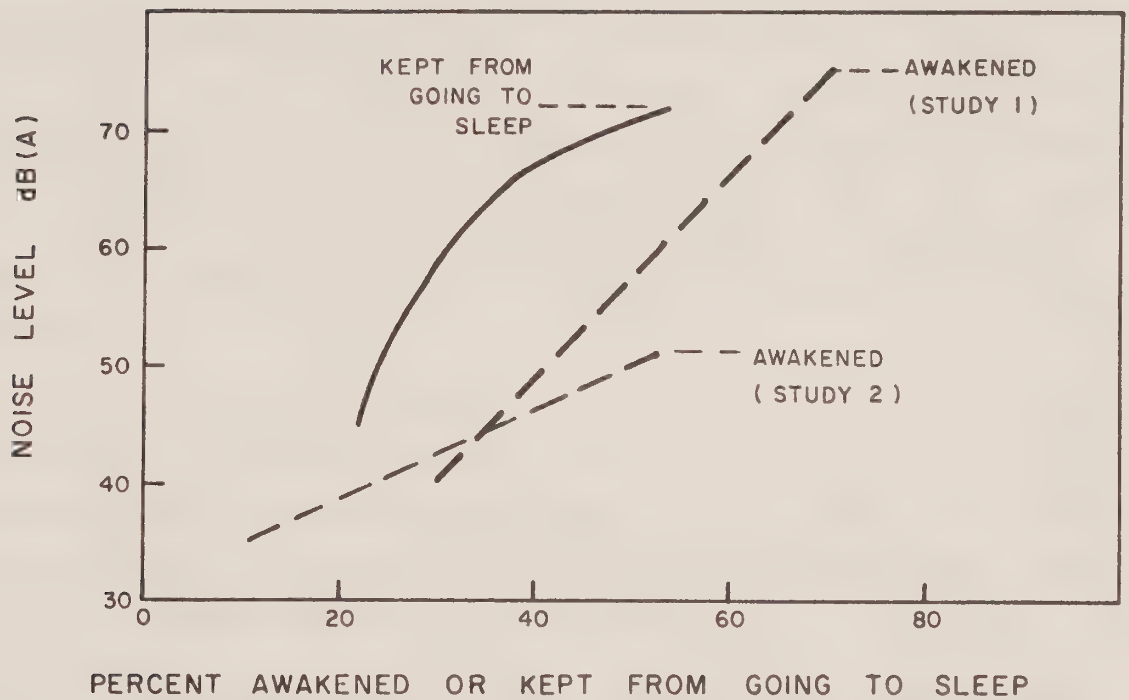



Figure 1

Shown are results of studies of the effects of noise on sleep, with noise levels expressed in decibels on the A-weighted scale (see Appendix B). Noise disturbs sleep in a gradually increasing manner, and 20 percent or more of the population suffers some form of sleep disturbance at 45 dB(A). Source: <u>Noise Pollution</u>, Hearings Before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, page 305.

some recent studies suggest that noise levels may be a factor in the rising rates of heart disease, ulcers, and mental illness, and it may have adverse effects on unborn children.[4]

Noises which are annoying have a number of secondary effects. The most obvious of these is interference with communication. A noise level that is not intense enough to cause hearing damage may still disrupt speech communication or interfere with the enjoyment of music or television. Also, interference with the ability to hear warning shouts or commands increases the probability of accidents.[5] Table 1 shows the effects of noise at various sound levels.

Another of these effects is economic loss due to noise. Speech interference caused by noise may influence commercial sales and reduce work output in jobs where interpersonal communication is important. Noise levels also may interfere with concentration and thus reduce work output in office spaces, particularly in those utilizing the open design concept.

Although it is not always the case, noise levels can affect property values and rentals in some areas, particularly adjacent to airports and heavily travelled highways. Maintaining low noise levels in open space recreation areas, such as campgrounds, parks, and areas of scenic beauty, may be important for the promotion of tourism, which can be of economic value to the county. There also may be economic benefit in maintaining relative quiet in commercial areas, because people will find it more enjoyable to shop in an environment which is not excessively noisy.[6]

Noise can cause certain species of animals, particularly predators, to abandon their habitat. A decrease in predatory species in an area can lead to overpopulation by other nonpredatory herbivorous species which might then propagate to such a level that they would deplete vegetation in the area. Hazards associated with soil erosion are greatly increased as vegetation is depleted.[7]

Livestock also can be adversely affected by noise. Excessive noise has been found to have an adverse effect upon both egg and milk production, and there also is evidence of reduced reproduction in the presence of noise.[8]

# PRIMARY EFFECTS OF NOISE

| EFFECT | NOISE LEVEL AT WHICH EFFECT OCCURS |
|---|---|
| HEARING LOSS | 75-85 dB(A) |
| EXTRA-AUDITORY PHYSIOLOGICAL EFFECTS | 65-75 dB(A) |
| SPEECH INTERFERENCE | 50-60 dB(A) |
| INTERFERENCE WITH SLEEP | 35-45 dB(A) |

Table 1

Shown are noise levels which affect various human activities. Levels are expressed in decibels on the A-weighted scale (see Appendix B). A noise of 85 dB(A) is approximately as loud as a Diesel truck, while 45 dB(A) is approximately as loud as bird calls.
Source: Noise Pollution, Hearings Before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, page 313.

The goals of Kern County with regard to noise are to minimize disruption of human activities and conflicts resulting from excessive noise, to protect the economic base of the county, and to protect the public health and welfare. This element contains a description of the noise problem, sets standards for maximum desired noise levels, and suggests a strategy for dealing with noise in Kern County.

# characteristics of noise

## What is Noise?

Noise may be thought of as sound which is undesirable or disturbing. Sounds which lack agreeable musical quality usually are considered to be noise. In addition, noise comprises those sounds which convey no useful information to the listener.[9] It is evident in the latter case that what is noise to one person may not be noise to another. A fire engine sounding its siren may be noise to occupants of nearby dwelling units, but it is useful sound to someone driving a car in the vicinity of the fire engine. Even though there can be some disagreement as to what constitutes noise, certain determinations can be made regarding acceptable noise levels. For example, sounds loud enough and of sufficient duration to damage hearing constitute excessive noise and should be controlled.

For a better description of noise, some of the basic properties of sound must be understood. Sound moves through the air somewhat like waves move in the ocean. Sound waves are alternate rings of compressed and rarefied air moving away from a central source at a constant speed. Individual molecules of air vibrate along the direction of the wave and in this way transfer the energy released at the source. (For a more detailed explanation of sound, see Appendix A.)[10]

There are two important characteristics of sound which must be considered in developing a noise control program: sound pressure level and frequency. Sound pressure level (SPL) is a measure of the pressures of the rings of compressed air making up the sound wave, and it corresponds roughly to the human perception of loudness. Frequency is the rate at which sound pressure is vibrating, and it corresponds to the perception of pitch.[11] The unit of frequency is Hertz (cycles per second). A sound wave at a frequency of 300 Hertz would cause 300 compression waves to strike the eardrum in one second. The unit for SPL, the decibel, requires an extended discussion, which is provided in the next section.

Other characteristics of noise to be considered relate to the type of noise being heard. Sounds at the same SPL but with different frequencies do not always seem equally loud. Within limits, higher frequencies sound louder than lower ones which are at the same SPL, and the higher pitched ones are

more annoying. Sounds which are varying in nature, such as sudden impacts or pulsations, are more annoying than steady sounds. Those with a rhythmic character are less bothersome than random ones.[12]

## Sound Measurement

The human ear can detect an extremely wide range of sound pressures and frequencies, and there are large individual differences in the ability to hear. Loudness is difficult to measure, since it depends on the ear and judgment of the individual observer. However, SPL is easily measured. The unit used to express SPL is the decibel. Zero on the decibel scale is defined in terms of a standard threshold of audibility, or the faintest sound the healthy human ear can detect. Not all persons, of course, can hear this level of sound, because some people are able to hear a broader range of sound than others.[13] Decibels (dB) are not linear units like inches or pounds. Rather they define a more rapidly increasing scale of pressure which is given in powers of 10 (logarithmic scale). While 20 dB exerts 10 times more sound pressure than 0 dB, 40 dB exerts 100 times more pressure, 60 dB exerts 1,000 times more pressure, and so on. The maximum possible level under standard atmospheric conditions is approximately 190 dB, at which three billion times more pressure is exerted than at 0 dB. Near 120 dB, sounds are loud enough to be painful. Table 2 shows the approximate sound level, in decibels, of various noises.

The dB rating of a particular sound decreases as the distance from the source increases. Therefore, the SPL from a distant source can be lower than that from a closer but fainter source.

The average ear is most sensitive to middle-range frequencies, those between 2,000 and 4,000 Hertz (abbreviated Hz); consequently, it is desirable to utilize a system for measuring sound pressure that takes into account differences in frequency. This element utilizes the "A-weighted scale," which is constructed so as to give greater weight to the pressure levels of sounds at frequencies to which the human ear is most sensitive. This scale, abbreviated as dB(A), is universally accepted as an adequate way to deal with the ear's different sensitivity to sounds of different frequency, and it is used in all

## APPROXIMATE SOUND LEVELS
## TYPICAL NOISE SOURCES

| SOUND LEVEL dB(A) | INDUSTRIAL | COMMUNITY | RESIDENTIAL |
|---|---|---|---|
| 140 | THRESHOLD OF PAIN | | |
| 130 | pneumatic riveter-130 | | |
| 120 | oxygen torch-121<br>compactor-116 | | |
| 110 | textile loom-106 | jet takeoff (1000 ft.)-110<br>snowmobile-105 | rock band-108-114 |
| 100 | electric furnace-100<br>newspaper press-97<br>rock drill-95 | farm tractor-98 | power mower-96 |
| 90 | milling machine-85 | motorcycle (50ft)-90<br>Diesel truck-85 | food blender-88 |
| 80 | lathe-81 | passenger car-75 | clothes washer-82<br>garbage disposal-80 |
| 70 | | | vacuum cleaner-70 |
| 60 | | air conditioner-60 | conversation-60 |
| 50 | | | |

Table 2

Source: <u>Noise Pollution</u>, Hearings Before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, page 22.

large-scale surveys of city noise coming from a variety of sources.[14] Noise in dB(A) can be read directly from sound level meters. The quantity thus measured is technically referred to as sound level.

A complete description of the noise environment requires additional information, such as the time of the occurrence (day or night) and its duration. To deal with these additional considerations, the following measurements also are used in this element:

1. $L_{10}$, Statistical A-Weighted Noise Level -- The noise level in dB(A) which is exceeded 10 percent of the time during which the noise is measured. This measurement scale is commonly utilized for the assessment of traffic noise. It represents the louder sound level occurring during the measurement period. A percentile scale can be used for other levels, such as $L_{50}$, which is the noise level exceeded 50 percent of the time, and so on.[15]

2. Community Noise Equivalent Level (CNEL) -- A measure of the cumulative noise exposure in the community, with greater weights applied to evening and nighttime periods. For CNEL calculations, day is defined as 7 a.m. to 7 p.m., and this period has a weighting factor of one; evening is 7 p.m. to 10 p.m. and has a weighting factor of three; and night is from 10 p.m. to 7 a.m. and has a weighting factor of ten. Noises occurring at night are given a substantially heavier weight, since for most people, this is the time when noise is most disturbing.[16] This CNEL scale is the one used to measure the noise level of commercial and general aviation airports in California.

3. Day-Night Average Sound Level, $L_{dn}$ -- The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period. Noise contours developed using CNEL and $L_{dn}$ procedures will normally agree within one dB(A), which is an insignificant difference. The $L_{dn}$ is a computational simplification of the CNEL, and it has been utilized by the

Kern County Health Department in developing noise contours for transportation sources in the county. This scale also is recommended by the U. S. Environmental Protection Agency for nationwide use.[17]

4. Average Sound Level, $L_{eq}$ -- Also called the equivalent continuous noise level. It is the continuous sound level that is equivalent, in terms of noise energy content, to the actual fluctuating noise existing at the location over a given period, usually one hour.[18]

# noise standards

## Criteria and Priorities

Considerable research has been done to determine the effects of various sound pressure levels on human health and on the successful performance of various human activities. It is known that noises of 120 dB(A) and higher will cause ear pain in most people; much lower levels may have permanent adverse effects on hearing. (See Figure 2.)

The federal standards for industrial safety regulate the amount of time workers may be exposed to sound levels above 90 dB(A). This level was selected on the assumption that inability to hear at frequencies above 2,000 Hz is unimportant to speech communication. Tests show, however, that hearing loss of this extent will have an adverse effect on hearing low-level conversation and on hearing ordinary speech in the presence of background noise levels which commonly occur in everyday listening conditions.[19] Therefore, this standard should be stricter.

Researchers who have conducted comparative studies of urbanized and primitive societies believe that continued exposure to noise levels of 70 dB(A) may produce a permanent hearing loss. Studies of the hearing acuity of African tribesmen revealed that elderly persons (those in their 70's and 80's) had hearing sensitivity only slightly less than young boys in the same tribe and that the hearing ability of these elderly persons was approximately equal to that of Americans 30 to 40 years their junior.[20]

It is desirable to control the "ambient noise level" to reduce the adverse effects of noise. Ambient noise is the all-encompassing noise associated with a given environment; it usually is a composite of sounds from many sources, near and far. Table 3 shows the response to various sound levels.

The U. S. Environmental Protection Agency and the California Department of Health have suggested standards for ambient noise. These standards, together with those contained in several local noise ordinances, have been utilized in developing noise standards in Kern County.

Of primary importance in controlling noise in Kern County is protection of the public health, particularly insuring against hearing loss resulting from community noise. Next in importance is minimization of adverse effects of noise on the economic well-being of the community, and third, minimization of annoyance caused by noise.

# HEARING LOSS FROM NOISE
# IN WORK ENVIRONMENT

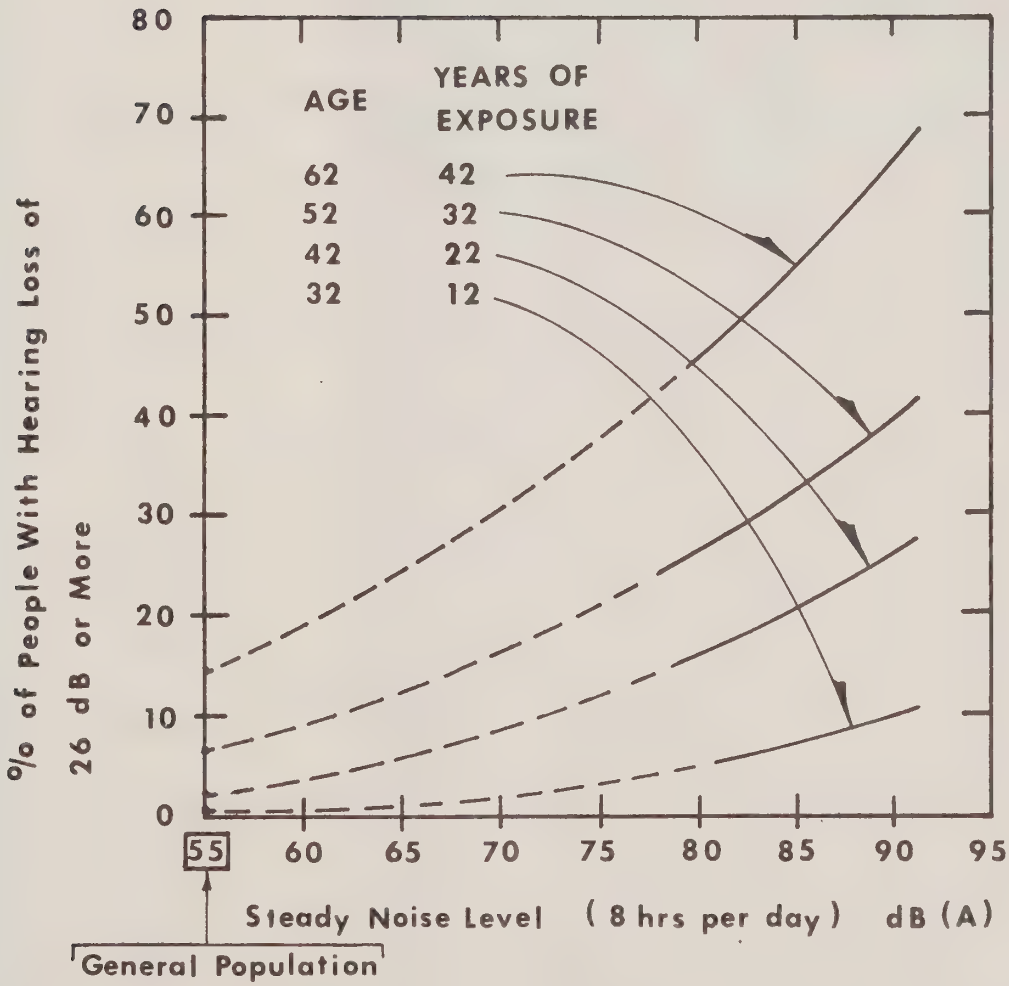



Figure 2

Shown is percent of population with hearing loss of 26 dB or greater when averaged at 500, 1000, and 2000 Hz as a function of steady noise level, 8 hours per workday, in decibels on the A-weighted scale (see Appendix B). It is seen that by the age of 62, about 65 percent of workers in 90 dB(A) environment would suffer as much or more hearing loss as that specified, whereas only about 15 percent of persons from the general population would have lost that much hearing by the age of 62.

Source: Noise Pollution, Hearings Before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, page 157.

# SOUND LEVELS and HUMAN RESPONSE

| Source | Noise Level | Response | Hearing Effects | Conversational Relationship |
|---|---|---|---|---|
| CARRIER DECK JET OPERATION | 150 | | | |
| | 140 | | | |
| | 130 | | | |
| JET TAKEOFF (200 feet) | 120 | | | |
| DISCOTHEQUE<br>AUTO HORN (3ft)<br>RIVETING MACHINE | | MAXIMUM VOCAL EFFORT | | |
| JET TAKEOFF (2000 feet) | 110 | | | SHOUTING IN EAR |
| GARBAGE TRUCK | 100 | | | |
| N.Y. SUBWAY-STATION | | VERY ANNOYING | | |
| | | HEARING DAMAGE (8 hr) | | SHOUTING (2ft) |
| HEAVY TRUCK (50 ft) | 90 | | | VERY LOUD CONVERSATION (2ft) |
| PNEUMATIC-DRILL (50 ft) | | ANNOYING | | |
| ALARM CLOCK | 80 | | | |
| FREIGHT TRAIN (50 feet) | | TELEPHONE USE DIFFICULT | | LOUD CONVERSATION (2ft) |
| FREEWAY TRAFFIC (50 feet) | 70 | INTRUSIVE | | LOUD CONVERSATION (4ft) |
| AIR CONDITION-ING UNIT (20 ft) | 60 | | | NORMAL CONVERSATION (12 ft) |
| LIGHT AUTO TRAFFIC (100 ft) | | QUIET | | |
| LIVING ROOM<br>BEDROOM | 50 | | | |
| | 40 | | | |
| LIBRARY<br>SOFT WHISPER (15 feet) | | VERY QUIET | | |
| | 30 | | | |
| BROADCASTING STUDIO | 20 | | | |
| | 10 | JUST AUDIBLE | | |
| | 0 | THRESHOLD of HEARING | | |

Table 3

Source: Noise Pollution, U. S. Environmental Protection Agency, page 6.

# REACTION TO COMMUNITY NOISE LEVELS

| LAND USE CATEGORY | MAXIMUM DESIRED NOISE LEVELS dB(A) | | LEVELS PEOPLE ACCEPT WITHOUT UNDUE COMPLAINT dB(A) | |
|---|---|---|---|---|
| | DAY | NIGHT | DAY | NIGHT |
| RURAL RESIDENTIAL | 35 | 25 | 35-45 | 25-35 |
| SUBURBAN RESIDENTIAL | 40 | 30 | 40-50 | 30-40 |
| URBAN RESIDENTIAL | 45 | 35 | 45-55 | 35-45 |
| COMMERCIAL | 55 | 45 | 55-65 | 45-55 |
| INDUSTRIAL | 60 | 50 | 60-70 | 50-60 |

Table 4

Shows differences between noise levels people would like and what they will accept. Noise levels are shown in decibels on the A-weighted scale (see Appendix B).
Source: Noise Pollution, Hearings Before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, pages 33-34.

## Land Use and Noise

There is a close relationship between land use and the level of noise which is tolerable. We expect our residential neighborhoods to be quieter than airports. Some land uses are unaffected by noise, while others are greatly affected. The various land uses can be divided into four categories according to noise sensitivity.

1. Insensitive Land Uses -- The noise level does not affect the successful operation of the particular activity. A wide variety of uses can be included in this category, including public utilities, transportation systems, and other noise-related uses.

2. Moderately Sensitive Land Uses -- Some degree of noise control must be present if these activities are to be successfully carried out. Included here are general business and recreational uses.

3. Sensitive Uses -- Lack of noise control will result in many of the effects described earlier in this element. This category primarily contains residential uses.

4. Highly Sensitive Uses -- A high degree of noise control is necessary for the successful operation of these activities. Examples include hospitals and churches.

A successful noise abatement program requires that standards established be easy to interpret and that they be relatively easy to measure with available equipment. The noise quality standards for Kern County represent a compromise between what people would like and what they will accept in terms of the noise environment. The standards are related to major land use activities, in the four categories described above. Examples of the land uses in each category are as follows:

## TABLE 5

### INSENSITIVE LAND USES

Agriculture
Horticulture
Livestock Farms
Forestry
Mining and Extraction
Water Areas
Natural Open Space
Undeveloped Land
Railways and Terminals
Transit Systems and Terminals
Auto Parking
Raceways and Drag Strips
Motorcycle Parks
Rifle Ranges
Liquid and Solid Waste Facilities
Industrial Manufacturing
Warehousing Utilities
Wrecking and Salvage Yards
Construction Yards

### MODERATELY SENSITIVE LAND USES

Country Clubs
Athletic Clubs
Tennis Clubs
Golf Courses and Driving Ranges
Equestrian Clubs
Scientific Testing
Government Services
Lodges, Community Associations
Restaurants and Bars
General Merchandising
Professional Offices
Recreational Vehicle Parks

## SENSITIVE LAND USES

Cemeteries
Single-family Dwellings (detached)
Single-family Dwellings (attached)
Multi-family Dwellings (low rise)
Multi-family Dwellings (high rise)
Dormitories
Resort Hotels
Out-Patient Clinics
Preschools
Motor Inns
Hotels
Professional Research
Mobilehome Parks

## HIGHLY SENSITIVE LAND USES

Single-family Dwellings (rural)
Educational Facilities
Hospitals
Convalescent Homes
Wildlife Sanctuaries
Churches
Auditoriums, Concert Halls

The categories indicate only the sensitivity of the use itself to noise, not how noise emitted from the use affects surrounding uses. For example, motorcycle tracks and drag strips themselves are not affected by noise; however, such uses next to a residential neighborhood would have a substantial adverse effect on the residential area.

### Noise Quality Standards

The following standards are established as the maximum desired ambient noise levels in Kern County:

TABLE 6

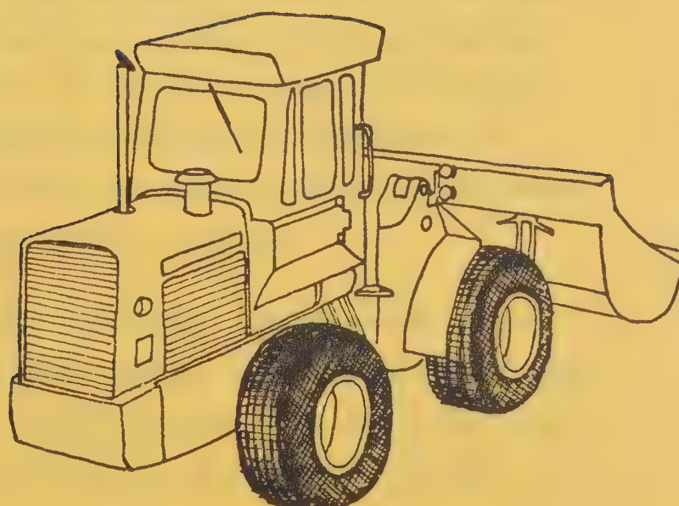
| LAND USE CATEGORY | $L_{50}$ NOISE LEVEL dB(A) DAY | NIGHT |
|---|---|---|
| Insensitive Uses | 60 | 55 |
| Moderately Sensitive Uses | 55 | 50 |
| Sensitive Uses | 50 | 40 |
| Highly Sensitive Uses | 45 | 35 |

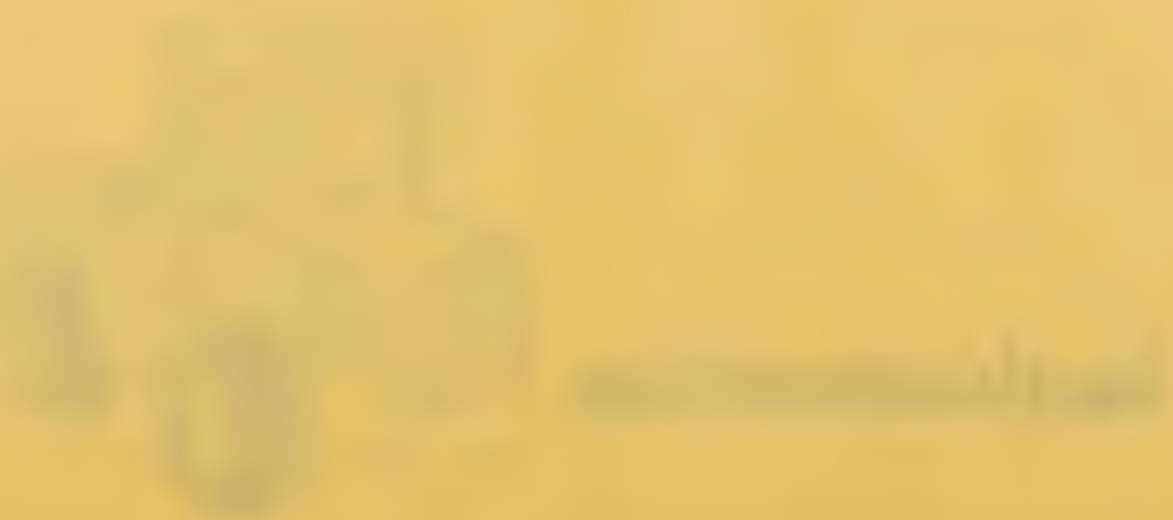
If noise is not smooth and continuous, one or more of the corrections below applies:

TABLE 7

| TYPE OF NOISE OPERATION | CORRECTION dB(A) |
|---|---|
| Noise source operated less than 15 minutes of any one-hour period | +5 |
| Noise source operated less than 5 minutes of any one-hour period | +10 |
| Noise source operated less than 1 minute of any one-hour period | +15 |
| Noise of impulsive character (i.e. hammering, etc.) | -5 |
| Noise of periodic character (hum, screech, etc.) | -5 |

# implementation





The effectiveness of a noise control program is dependent upon the effectiveness of the implementation measures utilized. This section of the Noise Element recommends an implementation plan which is designed to insure that the quality of the noise environment in Kern County will not deteriorate and will be improved wherever practical.

## Land Use Measures

Good land use planning requires that incompatible uses be separated from one another or that causes of incompatibility be mitigated. When an existing or a proposed land use is within a noise environment which exceeds the recommended levels for that particular use, mitigating measures should be instituted to resolve the conflict. These measures could include architectural design to reduce noise impact, acoustical insulation of exterior walls, or construction of sound barriers. In the case of a proposed use, approval should not be granted if such measures cannot reduce the noise level to the established standard. In some cases, mitigating measures are not possible because of economic or design limitations. In such cases, steps should be taken to permit only compatible land uses to be developed.

Zoning regulations can be utilized to assist in achieving noise-compatible land use patterns. The Kern County Zoning Ordinance should be amended to include performance standards for noise.

## Control of Transportation Noise

The various components of the transportation system are major contributors to noise. Measured from a distance of 50 feet, automobiles emit 70 to 75 dB(A), and Diesel trucks often reach 90 dB(A). A jet airplane flyover at 1,000 feet may be as loud as 103 dB(A). There are three ways to deal with the problem of noise from transportation sources: limit the amount of noise which can be emitted from a single source, provide appropriate acoustical treatment of transportation corridors (including construction of sound barriers), and separate noise-sensitive activities from transportation arteries.

Control of the noise source itself is outside the powers of the local jurisdiction. The federal Noise Control Act of 1972 charges the U. S. Environmental Protection Agency with the responsibility of setting standards for noise from all types of transportation vehicles. The California legislature has set

standards for control of noise emissions from automobiles, motorcycles, and trucks. Kern County can, however, utilize its police powers to enforce state regulations pertaining to transportation.

Acoustical Treatment

Highways -- Roadways should be depressed 15 to 20 feet below grade whenever possible, and an earth berm 10 feet higher than grade should be placed at the depression edge, thus creating an acoustical barrier with an effective height of 25 to 30 feet. In addition, there should be a right-of-way extending 200 feet beyond the pavement maintained as a permanent greenbelt. This type of highway design reduces the noise level approximately 15 dB(A) as compared to a highway at grade with no such acoustical treatment. The $L_{10}$ noise level at 200 feet would be approximately 60 dB(A).[21]

Existing highway systems which have a high impact on the noise environment in residential areas should be acoustically treated to reduce noise levels. A reduction of 11 dB(A) may be expected for freeways at grade where an 11-foot barrier is used (Figure 3). Elevated highways are 3 to 6 decibels quieter than at-grade roadways, and an additional 9- to 12-decibel reduction can be achieved by constructing an 8-foot solid barrier along the pavement edge.[22] (See Figure 4.)

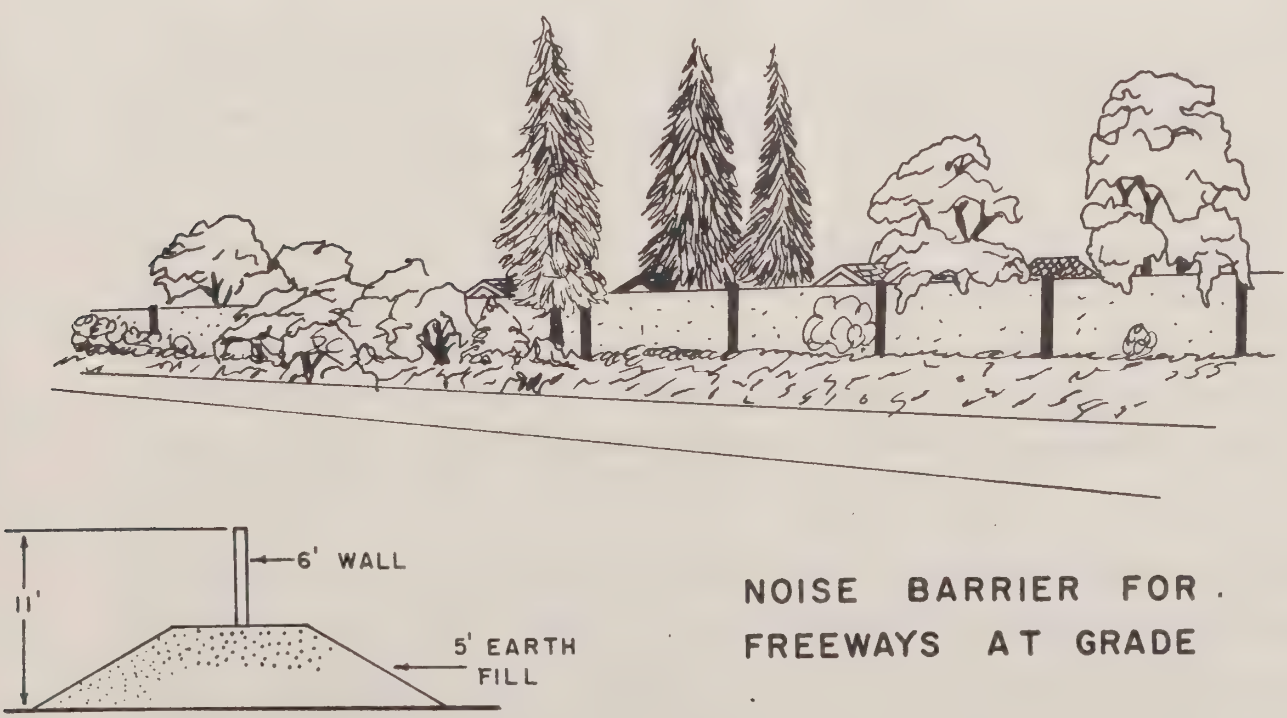



Figure 3

Source: Motor Vehicle Noise, California State Assembly, Committee on Transportation, page C-25.

# ACOUSTICAL TREATMENT FOR STRUCTURE OR EARTH FILL ELEVATED FREEWAY

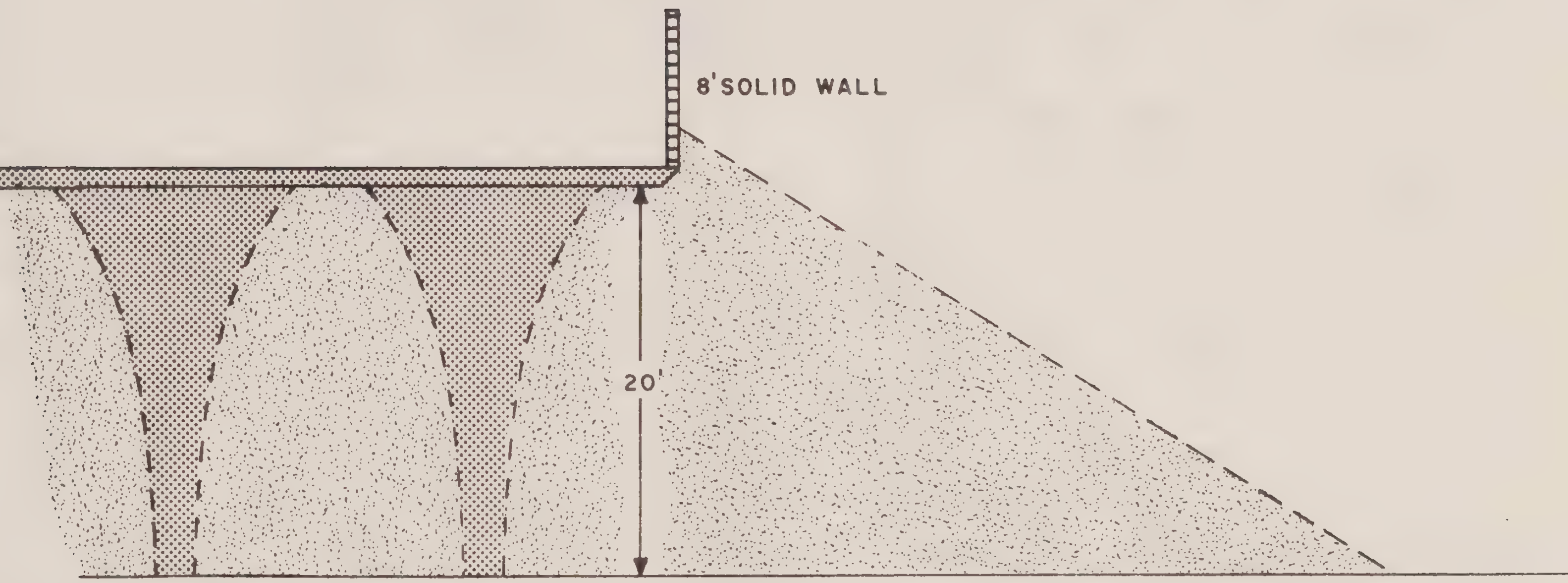



Figure 4

Source: Kern County Planning Department

In noise-sensitive areas, entrance and exit points should receive acoustical treatment similar to that described above, in order to provide maximum shielding from highway noise.

Railroads -- While railroads produce high noise levels during operation, the duration of operations at any given point is limited. In addition, yard operations are confined to a few specific areas, and the area affected by railroad noise is smaller than that affected by highways. There must be controls, however, on railroad operations in close proximity to residential areas, particularly between the hours of 10 p.m. and 7 a.m.

An acoustical barrier (Figure 5) can produce a 20 dB(A) reduction in the noise produced by wheel-rail interaction and a 12 dB(A) reduction in locomotive noise at distances greater than 300 feet from the barrier.[23] Such barriers also can reduce the noise levels from yard activities.

# SOUND BARRIER FOR RAILROAD LINE OPERATIONS

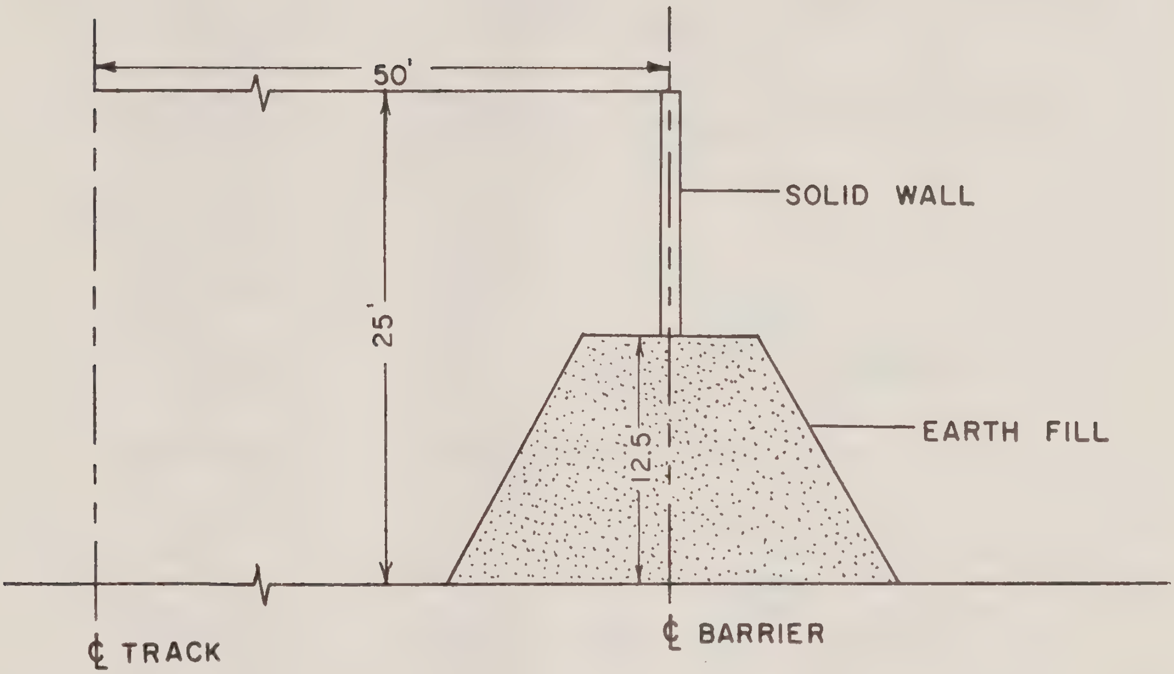


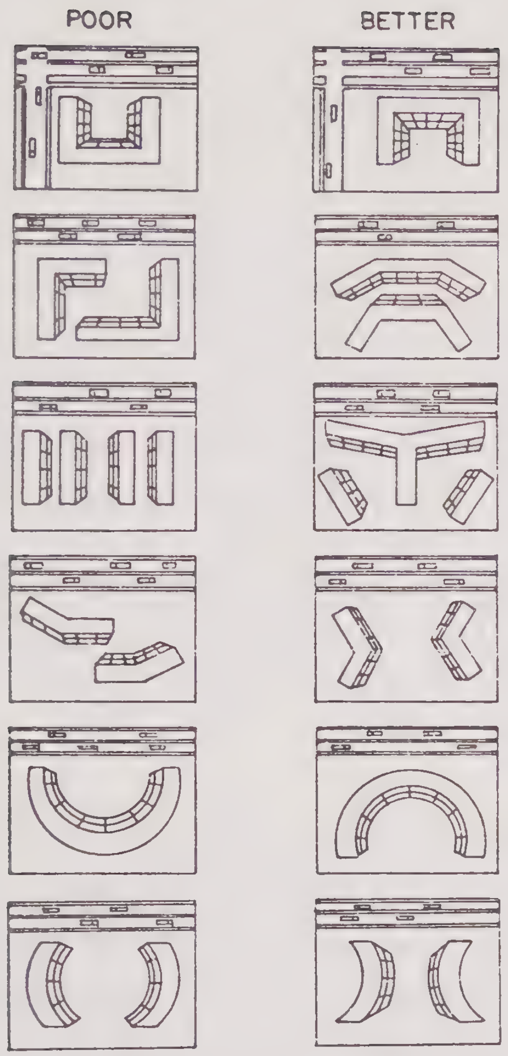

Figure 5

Source: Kern County Planning Department

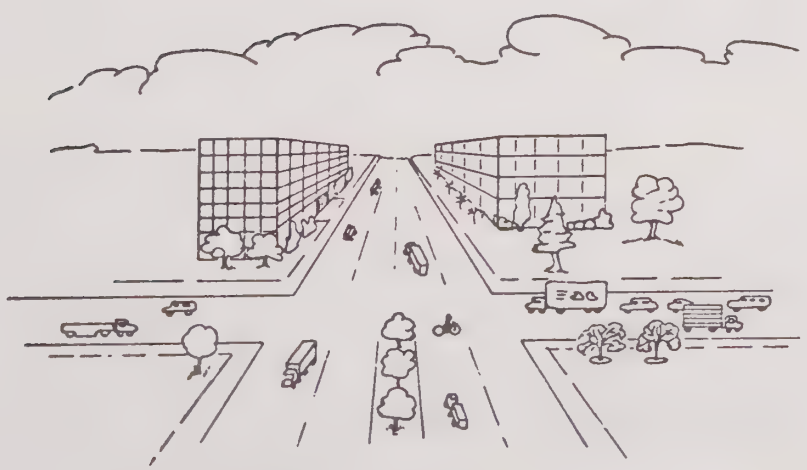
Airports -- There is little local control of noise emissions from airports. Some reduction in noise impact is possible, however, through adjusting flight patterns to minimize the number of residences affected by take-off and land approach patterns.

Noise Impact Zones

In order to resolve the noise problem as it relates to transportation facilities, "noise impact zones" should be delineated. In these zones, site plan review will be required prior to development approval for all projects. It is important to note that the zone boundaries do not represent fixed lines, but rather indicate general areas of noise impact. Development within these areas would be reviewed with respect to the existing noise environment, the noise quality standards, and the projected noise environment upon completion of the proposed project. Figure 6 illustrates some of the relationships between sitings and noise, and it shows how noise can be minimized by careful arrangement of buildings and highways.




BUILDING ORIENTATION ON SITE
FOR NOISE MITIGATION



BUILDING SITES NEAR TRAFFIC JUNCTIONS - SUCH SITES ARE EXTREMELY NOISY DUE TO ACCELERATION, DECELERATION AND BRAKING

BUILDING SITES NEAR TRAFFIC ARTERIES AND OTHER BUILDINGS

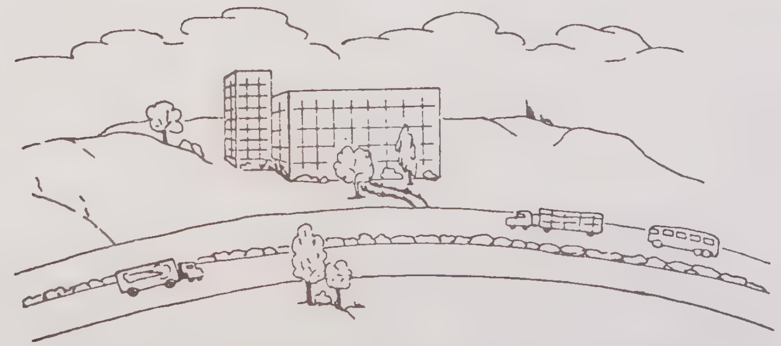
BUILDING SITE IN OPEN AREAS ARE LESS NOISY THAN SITES IN CONGESTED AREAS

TRAFFIC ARTERIES BETWEEN TALL BUILDINGS ARE QUITE NOISY

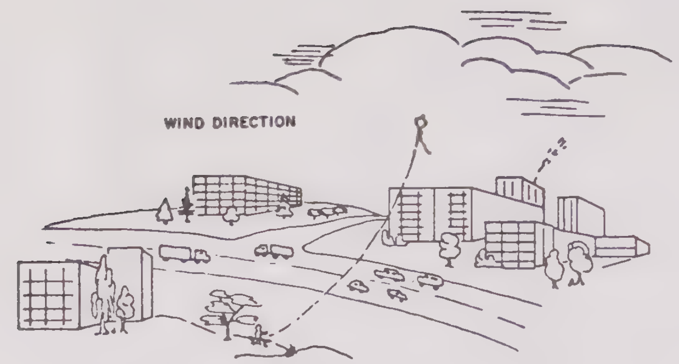
USE OF VARIOUS NOISE BARRIERS - ROAD EMBANKMENTS, NATURAL SCREEN


USE OF BUILDINGS AS NOISE BARRIERS

DEPRESSED AREAS ARE GENERALLY NOISIER THAN FLAT OPEN LAND.



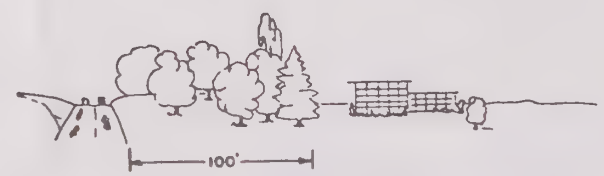
BUILDING SITES NEAR HILLY TRAFFIC AREAS - SUCH SITES ARE NOISY DUE TO LOW GEAR ACCELERATION NOISE.




SELECTION OF BUILDING SITES RELATIVE TO WIND DIRECTION UPWIND SITES ARE LESS NOISY.

GOOD SITE SELECTION UTILIZING NATURAL NOISE BARRIERS

POOR SITE SELECTION DISREGARDING EXISTING NATURAL NOISE BARRIERS




THICK LEAFY TREES AND UNDERBRUSH REDUCES NOISE ABOUT 6 to 7 dB / 100 FT. (AVERAGE OVER AUDIBLE FREQ. RANGE)
LOW FREQUENCY LOSS: 3 to 4 dB
HIGH FREQUENCY LOSS: 10 to 12 dB

SINGLE ROWS OF TREES DO NOT MAKE EFFECTIVE NOISE BARRIERS DUE TO INTER-REFLECTION. HIGH FREQ. REDUCTION 3-4 dB.

Figure 6

Source: Raymond D. Berendt, George E. Winzer, and Courtney E. Burroughs. A Guide To Airborne, Impact, and Structure-Borne Noise Control in Multiple-Family Dwellings. Pages 5-1, 5-2, 5-4.

Noise Impact Zones are to be established for each of the following major noise sources: highways, freeways, railroads, airports. The zones are intended to indicate areas of probable noise impact from each of these sources, based upon noise contours developed by the Kern County Health Department. The contours are shown in decrements of 5 dB(A) and are continued down to 55 dB(A) wherever possible. The state guidelines require continuing the contours to 45 dB(A) in areas containing hospitals, rest homes, long-term medical or mental care facilities, or outdoor recreational areas. From a practical standpoint, this requirement cannot be met. In some cases, there is no contour as low as 45 dB(A). When contours are carried to this extent, noise-measuring equipment picks up sounds from other sources, such as traffic on local streets. Noise monitoring will be carried out as a continuing process by the Kern County Health Department, and contours will be adjusted as necessary.

Noise Evaluation

It is recommended that a noise evaluation committee be organized in Kern County. This committee would function as a technical advisory group to the Board of Supervisors and to county departments. Membership would include representatives from the Departments of Health, Planning, Airports, Building Inspection, Public Works, Road Commissioner, and the Sheriff, and representatives from each incorporated city, along with citizen members acquainted with noise problems. These members should be appointed by the Board of Supervisors. Noise measurements and other data required by the committee would be supplied by the Health Department.

Noise Ordinance

The Health Department, utilizing information from its community noise survey, should prepare a noise control ordinance for Kern County. The ordinance would regulate noise emissions from fixed-point sources and would be administered by the Health Department. Such an ordinance should be reviewed by the noise evaluation committee and then forwarded to the Board of Supervisors for review and adoption.

Public Information

Information on noise and its control should be available to the public. It is recommended that the Health Education Division of the Kern County Health

Department be responsible for collection and dissemination of noise information. The noise evaluation committee also should participate in such an information program.

## Intergovernmental Cooperation

Kern County's noise control program should be coordinated with programs developed by the incorporated cities. Only through such coordination can there be effective control of community noise. The noise evaluation committee could provide the basis for joint efforts in this area.

## NOTES

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4. Noise Pollution, Environmental Protection Agency, p. 1

5. Ibid., p. 7

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7. Ibid.

8. Ibid.

9. Theodore J. Schultz, Noise Assessment Guidelines: Technical Background, U. S. Department of Housing and Urban Development, Washington D.C., G.P.O., September, 1970, TE/NA 172, pp. 9-10

10. Noise Pollution, Environmental Protection Agency, p. 3

11. Schultz, pp. 12-13

12. Ibid., p. 19

13. Ibid.

14. Ibid., p. 15

15. Impact Characterizations of Noise Including Implications of Identifying and Achieving Levels of Cumulative Noise Exposure, Environmental Protection Agency, NTID 73:4, 1973, pp. 4-5

16. Schultz, pp. A-8, A-9

17. Impact Characterizations, Environmental Protection Agency, pp. 6-7, 10

18. Schultz, pp. A-10, A-11

19. Noise Pollution, Hearings, p. 159

20. Noise Pollution, Environmental Protection Agency, p. 7

21. Technical Advisory Panel on Motor Vehicle Noise, Motor Vehicle Noise, Assembly Committee on Transportation, G.P.O., February, 1973, pp. C-23 - C-26.

22. Ibid.

23. Jack W. Swing and Donald B. Pies, Assessment of Noise Environment Around Railroad Operations, Wyle Laboratories, July, 1973, pp. 3-71, 3-73

# appendix A: technical background

[illegible]

[illegible]

This appendix contains brief technical explanations of sound and its properties. It is intended for those readers with some technical background who desire a fuller description of the problem of noise and its control. The information presented here is not essential to an understanding of the Noise Element and the Kern County noise control program. It is included only as added information for those who desire it.

DESCRIPTION OF SOUND

Sound is a mechanical wave motion in an elastic medium. This medium can be solid, liquid, or gas. The velocity of sound (V) depends upon and is fixed for each medium. The more rigid the medium, the faster the velocity. For example, if one were to put his ear to a rail, he could hear the sound of an approaching train sooner than if he listened for the sound in air.

Pressure

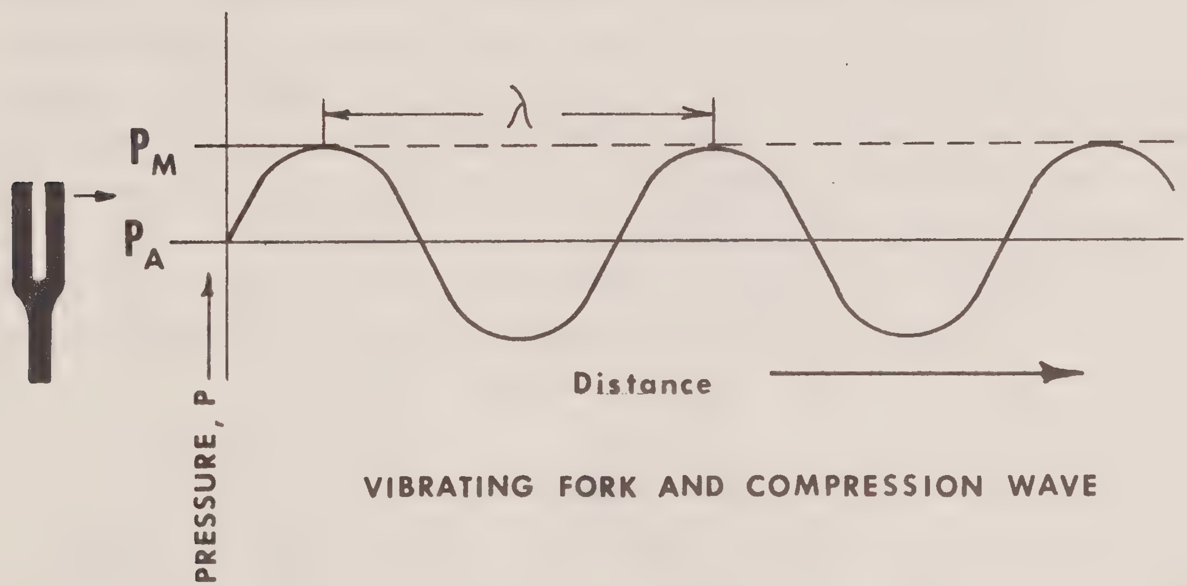



Figure A-1

Source: Kern County Planning Department

A vibrating fork (Figure A-1) can be used to demonstrate the wave motion of sound in air. As the fork vibrates to the right, it compresses the air to its right. The pressure and density of the air become slightly higher. The compressed air molecules transfer their energy away from the fork by collisions, and in this manner the pressure wave is sent. When the fork vibrates to the left, a low-pressure, low-density region (rarefaction) is formed to its right, followed by another compression. After a short while, the air mass to the right contains a set of evenly spaced compressions. The distance between them is called the wave length ($\lambda$). The compressions are shown graphically in Figure A-1 as a wavy curve of the pressure, P, which is regularly above and then below the atmospheric pressure, $P_A$. In Figure A-1, the maximum pressure is labeled $P_M$. Then the pressure difference $P - P_A$ reaches a maximum value of $P_M - P_A$. Normally, $P_A$ is near to 14.7 pounds/square inch,

while an audible pressure, $P_M$, can be larger than $P_A$ by as little as one millionth of $P_A$. Nonetheless, the human ear is a highly sensitive instrument, and it can easily detect these small pressure changes.

Frequency

Detectors known as sound meters also are sensitive to the small pressure variations in a sound wave. If a detector is placed at a point to the right in Figure A-1, the same number of compressions will strike it in one second as were set up by the fork. This number is called the frequency (f). Figure A-2 shows the pressure wave behavior at the fixed location of the detector. The interval in time between the arrival of successive crests, the period, also is shown in Figure A-2. Period, labeled T, is the reciprocal of frequency ($f = 1/T$). The unit for frequency is the Hertz (Hz), with one Hz equal to one cycle per second. Frequencies of sounds audible to humans are in the range of 20 to 20,000 Hz. Middle C on a piano has a frequency of 256 Hz, and concert A, above middle C, has a frequency of 440 Hz.

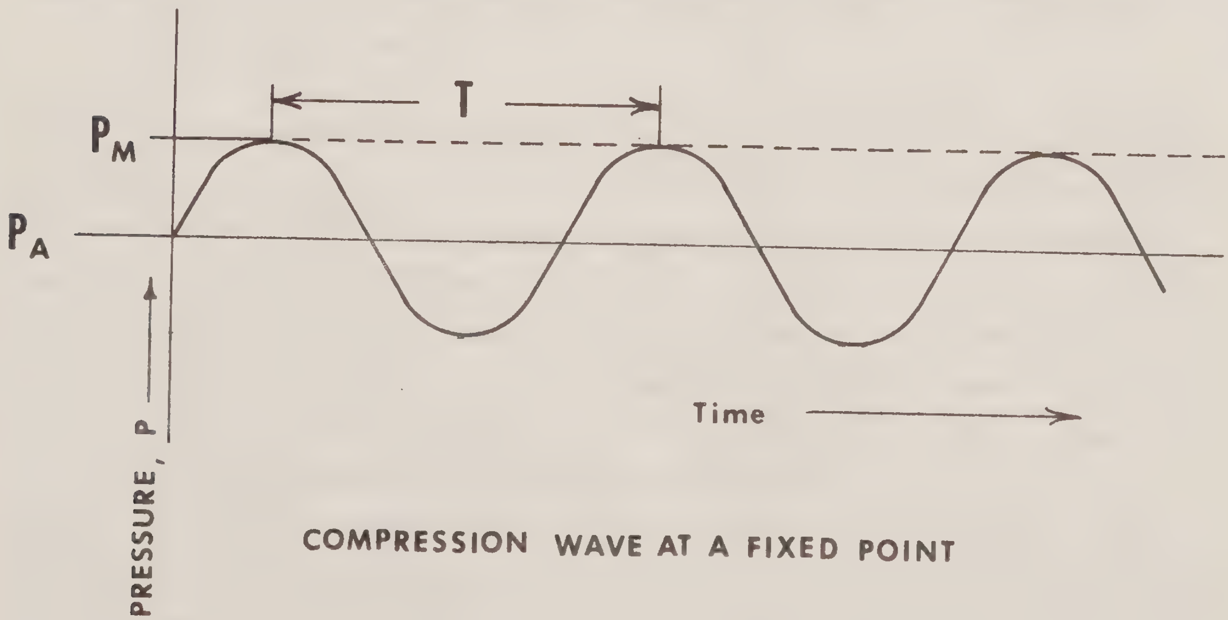



Figure A-2

Source: Kern County Planning Department

Students of wave motion know that velocity, V, wavelength, $\lambda$, and frequency, f, are related by the simple formula $V = f\lambda$. This is called the wave equation. By studying Figures A-1 and A-2, one can see that the wave equation is correct.

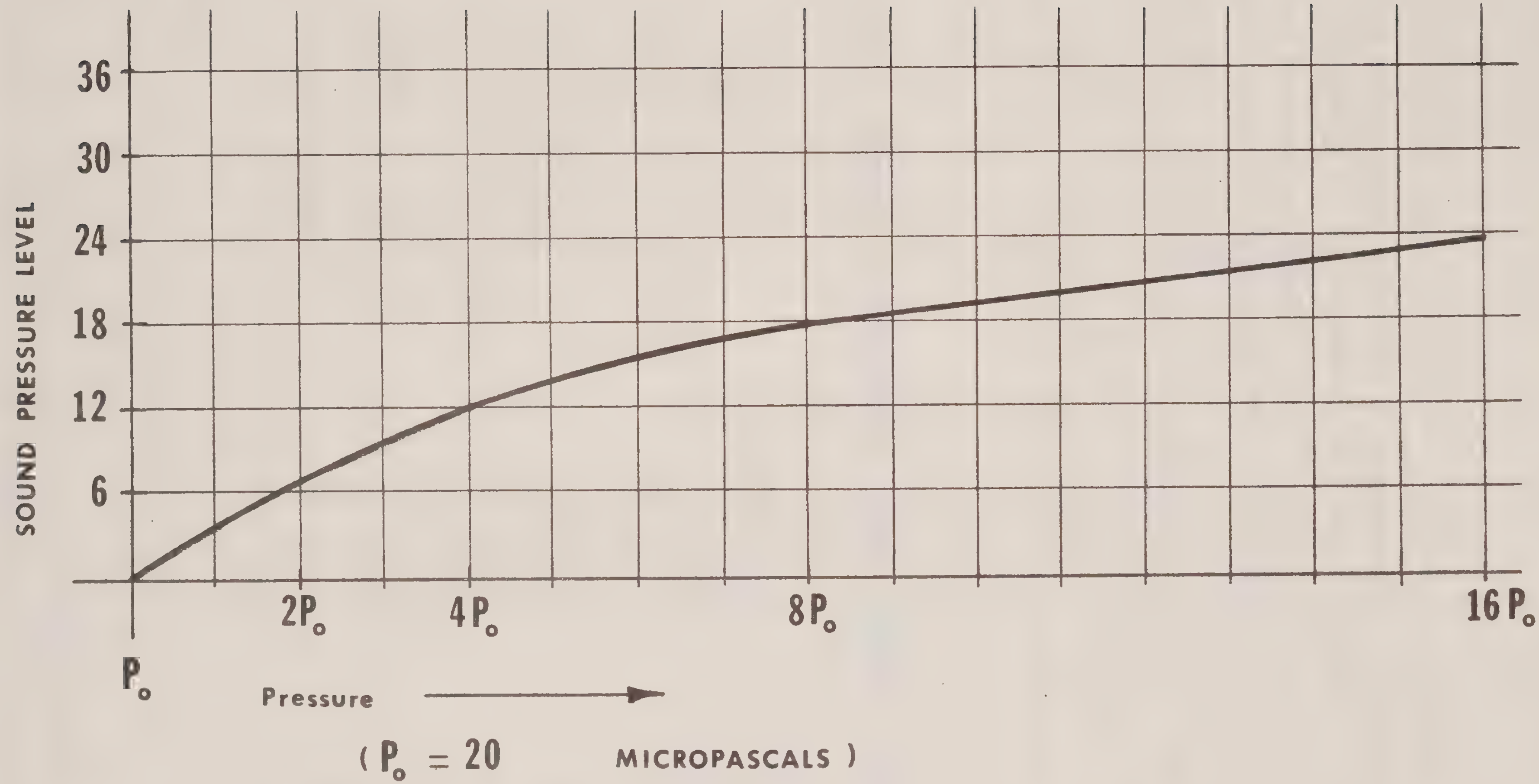
Attributes of Sound

There are three important attributes in the perception of sound: pitch, loudness, and tone quality. Pitch, or how high up the scale a sound seems, corresponds to frequency. Loudness corresponds to the pressure difference, $P_M - P_A$, of a sound wave. However, perceived loudness depends upon $P_M - P_A$ in a nonlinear manner, as is explained later in detail.

Tone quality is related to the admixture of different components of a sound having different frequencies. When a violin and a piano play the same note, such as middle C, the dominating frequency for both instruments is the same, but the instrumental sounds are easily distinguished because of the vastly different tone qualities. The violin sound has a different variety of frequencies (in addition to 256 Hz) than does the piano. A sound with only one frequency (or nearly one) is called a pure tone. A sound which contains a large admixture of many frequencies which differ greatly is called a broad-band sound. A narrow-band sound contains an admixture of frequencies which lie close to each other.

Loudness is discussed here in detail because it is an important attribute of noise. The major characteristic which makes so many sounds undesirable, and hence makes them become noise, is loudness. A sound meter measures the effective pressure difference, technically known as the rms (root mean square) value of $P - P_A$. Because $P - P_A$ goes negative, it averages to zero. That is, the average height of the pressure curves in Figures A-1 and A-2 above the axis, where P equals $P_A$, is zero. However, $(P - P_A)^2$ does not average to zero, because it cannot become negative. The rms value is $P_{rms} = \sqrt{(P - P_A)^2_{AV}}$, where AV refers to the average over a complete cycle. Roughly, $P_{rms}$ is proportional to the average of $P - P_A$ in the positive portion of the cycle of Figures A-1 and A-2. In this appendix, pressure of a sound wave always means $P_{rms}$. It should be clear that $P_{rms}$ is less than $P_M - P_A$. For the sine curve shown in the figures, $P_{rms}$ equals $(P_M - P_A)/\sqrt{2}$.

The standard unit for sound pressure is the pascal. One pascal is one Newton of force per square meter. The Newton is the metric unit of force, and it is approximately 7.23 pounds. The meter is approximately 39.37 inches. The micropascal, $10^{-6}$ pascals, is more convenient than the pascal, with $10^5$ micropascals being approximately equal to one standard atmosphere (14.7 pounds/square inch).




SOUND PRESSURE LEVELS CORRESPONDING to VARIOUS PRESSURES

Figure A-3

Source: Kern County Planning Department

The human ear can comfortably detect a wide range of pressures, from the standard threshold of hearing at 20 micropascals, to the threshold of pain at approximately $2 \times 10^7$ micropascals. If the pressure is doubled, the observed increase in loudness is not so great. A scale of loudness that is suitable for this phenomenon is the sound pressure level, which is a logarithmic scale. The sound pressure level (SPL) is given by $SPL = 20 \log_{10} \frac{P}{P_O}$, where $P_O = 20$ micropascals is the standard threshold of audibility. In Table A-1 are some typical values of pressure level above threshold. The unit of SPL is the decibel (dB). The relation between the two columns of numbers in Table A-1 clearly is not a simple proportionality, but rather it is nonlinear.

## TYPICAL VALUES OF PRESSURE LEVEL ABOVE THRESHOLD

| SOUND | PRESSURE (MICROPASCALS) | PRESSURE (dB) |
|---|---|---|
| Painful | $2 \times 10^7$ | 120 |
| Riveting | $1.1 \times 10^6$ | 95 |
| Elevated Train | $6.3 \times 10^5$ | 90 |
| Busy Street Traffic | $6.3 \times 10^4$ | 70 |
| Conversation in Home | $3.6 \times 10^4$ | 65 |
| Quiet Radio in Home | $2 \times 10^3$ | 40 |
| Whisper | $2 \times 10^2$ | 20 |
| Rustle of Leaves | 63 | 10 |
| Hearing Threshold | 20 | 0 |

Table A-1

Source: Kern County Planning Department

Suppose that traffic sounds on a busy street suddenly doubled their sound pressure, from $6.3 \times 10^4$ to $12.6 \times 10^4$ micropascals. By the formula, the pressure level increases from 70 to 76 dB. In Figure A-3, the SPL formula is presented graphically. This figure shows the nonlinear (i.e. curved) shape of the dependence of SPL upon P, shown for small values of P. This curve resembles the response of the human ear.

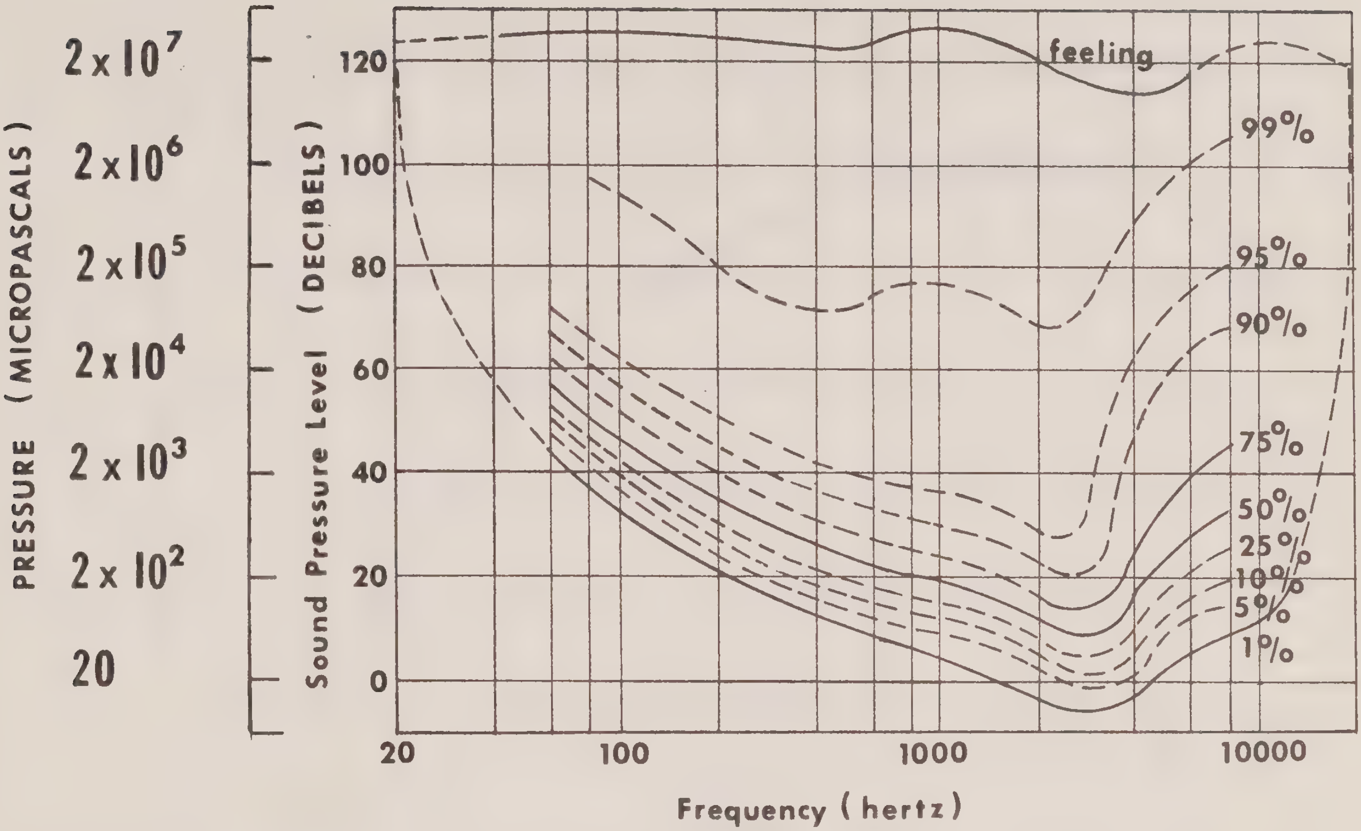
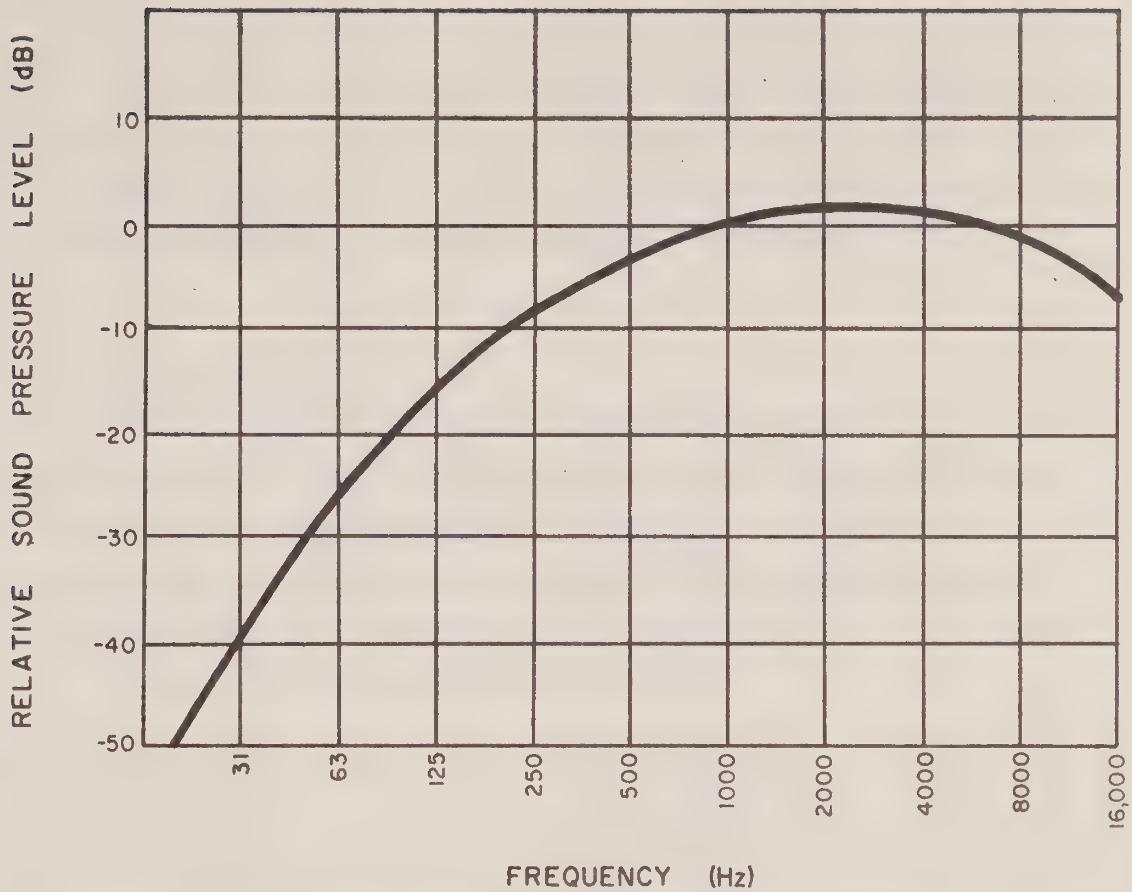



Figure A-4

Shown are the percentages of individuals who can hear sounds of various pressures.
Source: Adapted from George Shortley and Dudley Williams, Elements of Physics, 5th edition, page 254.

The threshold of audibility differs among people, and for the same person, it depends upon the frequency. Figure A-4 indicates these variations, and it also indicates the region of highest sensitivity of the average ear, which is between 2,000 and 4,000 Hz. Since auditory sensitivity varies with frequency, sound meters are built to take this into account. Sound meters commonly can be adjusted to give readings on the A-weighted scale, which corrects the pressures of the individual frequencies according to human sensitivities. The unit is written dB(A). Figure A-5 shows these corrections. According to Figure A-5, a 100-Hz sound of 70 dB would be lowered 20 dB to 50 dB(A), while a 2,000-Hz sound of 70 dB would be raised 3 dB to 73 dB(A).

Note that the A-weighted correction curve is similar to the inversion of the hearing threshold curve in Figure A-3. Effectively, a sound meter adjusted




INTERNATIONAL STANDARD A WEIGHTED SOUND LEVEL

Figure A-5

Source: Noise Pollution, Hearings Before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, page 224.

to the A-weighted scale detects sounds in much the same way as does the human ear. Very high and very low frequencies are given less weight, because the human ear is less sensitive to them.

## Attenuation

An attenuation, or a decrease in loudness of a sound, occurs when the observer increases his distance from the source. In open air, the attenuation of pressure follows an inverse first power law. This means that when the distance is doubled, the pressure is halved. Using the formula for pressure level leads to a decrease of sound pressure level of 6 dB when the distance is doubled. This rule is valid for all kinds of sounds in the open air.

Sound attenuates less when transmitted through a confined or limited medium. Using an earlier example, the iron rail transmits the sound of a train's wheels for a longer distance than air transmits the train's whistle. For the same reason, sounds tend to carry well between rooms in an acoustically uninsulated house. Absorbent insulation is needed when significant attenuation of sound is required in a confined or limited medium.

Other Sound Characteristics

Since noise is merely undesirable sound, all the discussion of sound in this appendix applies to noise. In addition to pitch, tone quality, and loudness, noise or any sound in a community has other characteristics. A sound can be steady, intermittent, or impulsive. An intermittent sound repeats itself, although not necessarily in a regular manner. An example would be the flyover of aircraft from a busy airport.

An impulsive sound has a sudden onset and short duration. Typical sounds classified as impulsive, such as gunshots or backfires of a car, last for one second or less. Sonic booms are in this category. Repeated impulsive sounds, such as riveting at construction sites, constitute a final category of sound.

# appendix B: definitions

ACOUSTICS -- (1) The science of sound, including the generation, transmission, and effects of sound waves, both audible and inaudible. (2) The sum of the physical qualities which determine the value of an enclosure (as an auditorium) to distinct hearing.

AMBIENT NOISE -- The all-encompassing noise associated with a given environment.

AMPLITUDE -- For a pressure wave in air, the maximum value of $P - P_A$. (See Sound Pressure.)

ATTENUATION -- Decrease in sound level, as when the observer increases his distance from the source; can be calculated in air by using the inverse first power law for pressure.

A-WEIGHTED SCALE -- A sound measurement scale which corrects the pressures of individual frequencies according to human sensitivites. The scale is based upon the fact that the region of highest sensitivity for the average ear is between 2,000 and 4,000 Hz. The unit is decibel(A), or just dB(A).

BROAD-BAND SOUND -- A sound whose waveform contains a large admixture of sine waves having many greatly differing frequencies.

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL) -- A measure of the cumulative noise exposure in the community, with greater weights applied to evening and nighttime periods. Day is defined as 7 a.m. to 7 p.m., and this period has a weighting factor of one; evening is 7 p.m. to 10 p.m. and has a weighting factor of three; and night is from 10 p.m. to 7 a.m. and has a weighting factor of ten.

DAY-NIGHT AVERAGE SOUND LEVEL ($L_{dn}$) -- The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period.

DECIBEL -- The unit of sound pressure level expressed by the formula $L = 20 \log_{10} (P/P_0)$. (See Sound Pressure Level.) One decibel (dB) is the approximate minimum change of sound pressure level detectable by the average human ear.

FREQUENCY -- The number of oscillations per second of a wave of sound or a vibrating solid object.

HERTZ -- A unit for expressing frequency. One Hertz (abbreviated Hz) equals one cycle per second.

IMPULSIVE SOUND -- Sound of short duration (typically less than one second), especially noise of high intensity, abrupt onset, and rapid decay.

INTERMITTENT SOUND -- Fluctuating sound whose level falls one or more times to low or unmeasurable values during an exposure.

INVERSE FIRST POWER LAW -- The rms pressure of a sound wave in a gas changes in inverse proportion to the distance from the source.

LOUDNESS -- A listener's perception of sound pressure incident on his ear.

NARROW-BAND SOUND -- A sound whose waveform contains an admixture of sine waves having frequencies which lie close to each other.

NOISE -- Unwanted sound; sound which lacks musical quality; sound which conveys no useful information to the listener.

NOISE CONTOURS -- Line passing through points where the same sound level prevails.

NOISE IMPACT ZONE -- An area bordered by noise contours which indicate the area is strongly affected by noise from transportation sources.

PASCAL -- A standard unit for measuring sound pressure; equal to one Newton of force per square meter, or approximately 7.23 pounds. One micropascal equals $10^{-6}$ pascals.

PERIOD -- Time interval between the arrival of successive repetitions of a waveform.

PITCH -- A listener's perception of the frequency of a sound.

PURE TONE -- A sound whose waveform is a single sine wave.

RANDOM NOISE -- A noise whose amplitude varies irregularly in time.

RMS PRESSURE -- Root mean square pressure of a wave. Equals $\sqrt{(P - P_A)^2_{AV}}$, where $P_A$ is atmospheric pressure and AV denotes an average.

SOUND -- A mechanical wave motion in an elastic medium.

SOUND LEVEL -- The weighted sound pressure level measured by the use of a sound meter. Calibration is frequently in dB(A) units.

SOUND METER -- An instrument consisting of a microphone, an amplifier, an output meter, and frequency weighting networks; used for measurement of sound levels.

SOUND PRESSURE -- The total instantaneous pressure at a particular point in the presence of a sound wave minus the static pressure at that point; equals $P - P_A$.

SOUND PRESSURE LEVEL -- A quantity, expressed in decibels, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of this sound to the reference pressure. The reference pressure is $P_O = 20$ micropascals. The formula is $L = 20 \log_{10} P/P_O$.

STEADY SOUND -- A sound whose characteristics remain constant in time.

TONE QUALITY -- A listener's perception of the waveform of a sound.

WAVEFORM -- The shape of a curve defining a particular type of wave motion. A particularly simple waveform is the sine wave, shown in the appendix.

WAVE MOTION -- A transfer of energy from one point to another without physical transfer of material between the points; accomplished in a material medium such as air through oscillations induced in the individual molecules of the medium.

# appendix C:
# noise contours

Noise level contours are available for transportation sources as specified in the state law. These contours have been prepared by the Kern County Health Department in accordance with methodology developed by Wyle Laboratories. Maps showing the official contours are on file at the Kern County Planning Department, where they are available for public review. The contours for each source are described briefly below.

Airports

Airport noise level contours, expressed in decibels on the Community Noise Equivalent Level (CNEL) scale, have been prepared for all major airports in Kern County. They are to be used in implementing the noise insulation standards for multiple-occupancy dwellings stipulated by the California Administrative Code, Title 25, Section 1092. These contours also may be used by airport authorities to determine whether their airports have a noise problem as defined by the California Administrative Code, Title 4, Section 5050. The noise contours may cross city-county boundaries. Coordinated action by the county and the affected cities should be encouraged in order to ensure a uniform approach to land use policy when airport noise level contours affect both the county and a city.

It is important that the airport noise contours be reviewed periodically, because airport traffic volumes are subject to marked changes as the popularity of flying increases or additional development occurs. In addition, the retro-fitting of present aircraft with quieter engines and the increase in numbers of new, quieter aircraft may have some effects upon the noise generated in relation to traffic volume. New airports or airport extension projects should be required to provide estimates of noise impacts as part of their approval process, and land use planning in those areas should reflect those estimates.

Highways

Highway noise level contours, expressed in decibels on the Day-Night Noise Level Scale ($L_{dn}$), have been prepared for specific portions of the major highway routings in Kern County. These contours have been developed for

all major highway intersections and routings of major highways through areas of urban influence. The contours have been developed by the Kern County Health Department in accordance with the methodology developed by Wyle Laboratories, and the boundaries of these intervals may be considered accurate to $\pm 3$ dB(A). They are not intended to provide distinct boundaries between specific noise levels, but rather they should be treated as empirical devices, based upon typical sources and applied to typical situations. They may be used to mark zones of influence and as indicators of where specific studies should be conducted. The highway contour intervals have been supplied for all major highway routings in critical areas of the county for 1973 traffic flows, and they have been projected to 1995 for critical highway intersections and other selected segments.

Railroads

Railroad noise level contours, expressed in decibels on the CNEL scale, have been prepared based upon information supplied by the railroad companies. These contours were prepared by the Kern County Health Department according to methodology developed by Wyle Laboratories and may be considered accurate to $\pm 3$ decibels. Contour intervals shown on maps on file at the Kern County Planning Department are for 1973 and 1995 rail traffic volumes. As with other contours, the railroad contours are intended to mark noise impact zones and not as inflexible boundary lines.

Contour Maps

All contours discussed here are mapped and are available at the Kern County Planning Department. These contours will be altered and new ones will be added as conditions warrant. When noise data are needed for areas not shown on the contour maps, the Kern County Health Department will be asked to prepare contours for the area(s) in question. For purposes of interpreting the contours, the CNEL and $L_{dn}$ scales can be considered equivalent. The relationship between these scales and the noise contours is given on the table below.

Table D-1

| LAND USE CATEGORY | $L_{50}$ NOISE LEVEL dB(A) | | $L_{dn}$ |
|---|---|---|---|
| | Day | Night | |
| Insensitive Uses | 60 | 55 | 70 |
| Moderately Sensitive Uses | 55 | 50 | 65 |
| Sensitive Uses | 50 | 40 | 55 |
| Highly Sensitive Uses | 45 | 35 | 50 |

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